DEVICE FOR AUTOMATICALLY LOADING AND FIRING FOAM PELLETS

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of a provisional application number 60/448,135 filed on February 20, 2003.

FIELD OF THE INVENTION

This invention relates to an apparatus for the cleaning of tubes. More particularly, to an improved apparatus for the rapid loading and launching of foam pellets. Thereby, reducing the cost and deriving a savings from the reduction of down time and cost of environmental waste disposal.

BACKGROUND OF THE INVENTION

Contamination of hose, tube and pipe represents a significant problem to industry as it directly causes mechanical failures requiring extensive repairs at a significant expense. Commercial tube cleaning systems were originally developed to effectively remove contamination from hydraulic lines, arising from the manufacture, cutting and fitting of new assemblies. Applying traditional cleaning methodologies, such as, pull-throughs, forced air, vapor degreasing or flushing with oils, solvents or chemicals is inefficient due to the related significant labor and material costs. In addition, solvents and chemicals utilized in the cleaning process present a hazard to the user and create disposal problems, regarding the toxicity of the chemicals and the related environmental concerns

Particularly, industry has been looking for ways to clean hydraulic tubing that can replace the current method of vapor degreasing. A vapor degreaser is a large organic solvent still in which the solvent vapor condenses on and drains off the parts to be cleaned. Vapor degreaser systems are large, fixed installations that have a high purchase price and maintenance costs. Due to its potential air pollution and health risks, companies that use this method must also obtain a yearly operating permit for their

facilities from the Clean Air Agencies. Replacing these vapor degreasers with a small, low-cost cleaning method will allow installations to consolidate sites and save money.

One such method is to propel a polyurethane foam pellet through the tube using compressed air. The tight fitting foam scrubs the interior wall of the tube as it passes through. The pellet system is currently used to clean tubes at a relatively high rate in close quartered work cells. Tubes are bent into a large variety of complicated shapes and lengths. Pellets must be loaded, launched/retrieved and examined with a minimum of operator movement. However, equipment that requires an operator to locate and retrieve the spent pellet lowers productivity. Also, safety and noise consideration require that the pellets be fired into a containment device to reduce the noise to acceptable levels. This is a widely used technique and there are at least 3 manufacturers of foam pellets and foam pellet launching equipment worldwide. One component lacking from the vendors is a rapid firing launcher of the pellets. Unfortunately, the commercial equipment available to launch foam pellets into tubes is unsuitable for high production rates and a factory environment.

One type of available commercial equipment is a pellet pistol attached to a compressed air hose. The pistol is portable and flexible enough to facilitate its muzzle being positioned at the end of the tube to be cleaned. Nonetheless, the pistol is only single shot and must be breached and hand loaded each time a pellet is to be fired, therefore, reducing its efficiency. Another available unit is a bench-top device that forces the operator to place the tube-end to the device. Although the bench top device features an automatic chambering device which allows the foam pellets to be deposited through a port in its top, the pellets must be chambered by hand one at a time.

This invention remedies both problems by possessing an automatic loading function and a flexible barrel and muzzle. Therefore, providing an innovative, unique and useful alternative to commercially available foam pellet launchers for tube cleaning. This apparatus speeds up the process and provides productivity improvements because the pellet method allows the user to go from the current batch-processing method to one-piece processing in work cells. In addition, it alleviates the environmental concerns associated with the chemical, oil, vapor degreasing or solvent tube cleaning

methodologies.

SUMMARY OF THE INVENTION

The present invention provides an innovative, unique and useful alternative to commercially available foam pellet launchers for tube cleaning. This attachment provides a quick and efficient automatic loader and launcher for foam pellets. The invention comprises foam pellets that are gravity fed through a tubular magazine into a cylindrical vertical passageway in a block. This passageway is intersected at a right angle by a cylindrical horizontal passageway about the middle of the block. Below this horizontal passageway the vertical bore has a valved port. The valve releases compressed air into the passageway on a piloted air command. Free to slide in the horizontal passageway, a cylindrical shuttle is attached at one end to a pneumatic actuator. At its opposite end is a hole slightly larger than and aligning with the vertical bore when the shuttle is extended. Also at this end, the shuttle has a pin through it that extends through slots on opposite sides of the block. This pin can contact a spring loaded release lever and rotate it about an axle through the block. The release lever straddles the block and has a projection that protrudes through a small hole intersecting the vertical passageway in the block previously described.

Operation starts with one pellet in the chamber below the air injection port. The shuttle is in the retracted position, the opening in it aligned with the vertical passage. The pin on the shuttle does not contact the lever allowing the projection on the lever to forcibly contact the lowest pellet above the shuttle in the vertical passage. In this position, no pellets are allowed to fall through the opening in the shuttle to the bottom.

On triggering, the shuttle is pushed into the forward position by the actuator, first blocking the vertical passage, then as it moves farther, the pin pushing the release lever back and releasing the pellets. The pellets drop together until the lowest one rests on top of the shuttle. Once the shuttle is fully forward, an air threshold sensor on the cylinder detects this condition and opens the piloted valve. The compressed air behind the pellet forces it through the lower fitting into the flexible hose acting as the gun barrel. The

pellet exits a muzzle at the other end of the hose and is propelled through the tube being cleaned. The shuttle remains in the forward position and air continues to flow as long as the trigger is held down.

After the trigger is released, the shuttle moves rearward but before the hole in it realigns with the vertical passage, the projection on the release lever forcibly contacts the foam pellet immediately above the one resting on the shuttle. As the shuttle continues to move to the rear position, the opening comes into alignment and a single foam pellet descends into the lower portion of the block. The device is now again in the starting position.

Additional objects, advantages and novel features of the invention will be set forth in part in the description in which the preferred embodiments have been set forth in conjunction with the accompanying drawings which follow, and in part will become apparent to those skilled in the art upon examination of the following or may be learned by practice of the invention. The objects and advantages of the invention may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims. Other features and advantages of the present invention will be apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and form part of the specification, illustrate an embodiment of the present invention and together with the description, serve to explain the principles of the invention. In the drawings:

Figure 1 shows an embodiment of the invention;

Figure 2 shows an exploded view of some of the major components of the invention;

Figure 3 shows a detailed cross-sectional view of the invention with its release lever in the locked position; and

Figure 4 shows a detailed cross-sectional view of the invention with its release lever in the unlocked position.

There may be additional structures described in the foregoing application that are not depicted on one of the described drawings. In the event such a structure is described but not depicted in a drawing, the absence of such a drawing should not be considered as an omission of such design from the specification.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in detail to the present preferred embodiment of the invention, an example of which is illustrated in the accompanying drawings. While the invention will be described in connection with a preferred embodiment, it will be understood that it is not intended to limit the invention to that embodiment. On the contrary, it is intended to cover all alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention defined in the appended claims.

Referring to figures 1, and 2, the device for automatically loading and firing foam pellets (100) comprises a block (1) that contains a cylindrical vertical passageway (11). Foam pellets are gravity fed through a tubular magazine (not shown) into said cylindrical vertical passageway (11) of said block (1). This passageway is intersected at a right angle by a cylindrical horizontal passageway (12) about the middle of the block (1). Below this horizontal passageway (12) the vertical bore has a valved port (10). The valve (9) releases compressed air into the passageway (11) on a piloted air command. Free to slide in the horizontal passageway, a cylindrical shuttle (3) is attached at one end to a pneumatic actuator (8). At its opposite end is a hole (13) slightly larger than and aligning with the vertical bore. When the shuttle (3) is extended the shuttle (3) has a pin (5)

through it that extends through slots (16) on opposite side of the block (1). This pin (5) contacts a spring loaded release lever (4) and rotates it about an axle (6) through the block (1). The release lever (4) straddles the block (1) and has a projection (17) that protrudes through a small hole (15) intersecting the vertical passageway (11) of the block (1) previously described.

Referring to FIG. 3, operation starts with one pellet (a) in the chamber below the air injection port (11). The shuttle (3) is in the retracted position, a hole (13) is aligned with the vertical passageway (11). The pin (5) on the shuttle (3) does not contact the lever (4) allowing the projection on the lever (4) to jam the lowest pellet (b) above the shuttle (3) in the vertical passageway (11). No pellets can fall through the hole (13) in the shuttle (3) to the bottom. Referring to FIG. 4, on triggering, the shuttle (3) is pushed into the forward position by the actuator (8), first blocking the vertical passageway (11), then as it moves farther, the pin (5) pushing the release lever (4) back releasing the pellets. The pellets drop together until the lowest one (b) rests on top of the shuttle (3). Once the shuttle (3) is fully forward, a pneumatic actuator (7) on the shuttle (3) detects this condition and opens the piloted valve (10). The compressed air behind pellet (a) forces it through the lower block (2) that contains a cylindrical vertical passageway (18) that is aligned with the vertical passageway of block (1). The lower block also contains four (4) openings located at the corners of the lower block (2) for the insertion of bolts (11). Attached to the lower block (2) is the lower fitting (9) that the flexible hose (not shown) is attached, acting as the gun barrel. The pellet exits a muzzle at the other end of the hose (not shown) and is propelled through the tube being cleaned. The shuttle (3) remains in the forward position and air continues to flow as long as the trigger is held down.

When the trigger is released the shuttle (3) moves rearward but before the hole (13) in it realigns with the vertical passage (11), the projection on the release lever (4) jams the pellet (c) immediately above the one resting on the shuttle (3). As the shuttle (3) continues to move to the rear position, the hole (13) comes into alignment, and a single pellet (b) falls into the lower portion of the block (2). The device is now in the starting position again.

The foregoing description of the preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and obviously many modifications and variations are possible in light of the above teachings.